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PLANTS AND WEIGHTLESSNESS

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Translation of "Rasteniya i nevesomost'", Tekhnika i nauka, No. 11 (1978) p 10

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16. Abstract

As is apparent the time is at hand when permanent inhabited stations are launched into near-earth orbits and space "gardens" will be raised there to replenish the food supplies. Therefore, the effect of weightlessness on plants has been under study for a long time, and in particular the role of the gravity force in the spatial orientation of the plants has been revealed. But the processes of growth and morphogenesis under these conditions have still been studied little. It is especially not clear what is the effect of weightlessness on the entire cycle of development of plants as a whole, for there are known experiments both on space stations and on special apparatus (klinostats and the program "Biosatellite-2") that simulate on earth weightlessness that were set up for a short-term and only touched individual phases of plant development.

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PLANTS AND WEIGHTLESSNESS

By
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As is apparent the time is at hand when permanent inhabited stations are launched into near-earth orbits and space "gardens" will be raised there to replenish the food supplies. Therefore the effect of weightlessness on plants has been under study for a long time, and in particular the role of the gravity force in the spatial orientation of the plants has been revealed. But the processes of growth and morphogenesis under these conditions have still been studied little. It is especially not clear what is the effect of weightlessness on the entire cycle of development of plants as a whole, for there are known experiments both on space stations and on special apparatus (klinostats and the program "Biosatellite-2") that simulate on earth weightlessness that were set up for a short-term and only touched individual phases of plant development. /10*

The scientists of the Institute of Botany of the Lithuanian SSR Academy of Sciences (Vilnius) set the goal of tracing the growth of plants for their entire lifetime in weightlessness. Two plants became the experimental: long-day --wall cress and short-day--red goosefoot. Of course the necessary illumination and temperature for the plants were maintained. From the viewpoint of statistics the experiments were set up to be fairly representative: the wall cress growth was observed for 35-37 days, and red goosefoot growth, somewhat longer, 100-110 days.

*Numbers in margin indicated pagination in original foreign text.

In the beginning both plants behaved normally, familiar for us and also for the plants themselves: the seeds sprouted in the normal periods, and the shoots did not differ in any way from the control plants. It is true that certain roots lost their normal orientation and did not go deeper into the nutrient medium, but rather crept over its surface. But then both the wall cress and the goosefoot slowed down their normal rate of growth, which became noticeable from the rate of formation of new leaves in the wall cress and stem development in the goosefoot. Although no disorders were successfully found in the morphology (internal structure) of these two plants, almost half of the experimental cress and goosefoot plants ceased growth completely, yellowed and died. The other part continued to develop normally and by the end of vegetation differed from the normal plants only in a lower height. Not all were fertile since certain experimental plants, after losing spatial orientation became twisted and produced sterile flowers.

What determined the fate of the plants? The Lithuanian scientists hypothesized that not all the plants had the same sensitivity to gravity: those survived and developed that were more resistant. And the seeming delayed reaction of the plants to weightlessness can be explained, apparently, by the thousand-year "habit" of the seeds being accustomed to terrestrial conditions. The terrestrial habits can be erased by weightlessness only with time, after many days of influence, when the seeds have already sprouted and the period of active development of the plants begins. Then the new conditions already have their noticeable effect on the fate of the "root earth dwellers."